application into better form for Appeal should an Appeal be necessary. The Amendment does not present any additional claims without canceling a corresponding number of finally rejected claims, does not raise the issue of new matter, and does not raise any new issues requiring additional search and/or consideration since the Amendment is directed to subject matter previously considered during prosecution. Furthermore, the amendments are necessary and were not earlier presented because they are in response to issues raised in the Final Rejection. Similar reasoning for entry also applies to the attached two Declarations Under 37 C.F.R. §1.132. Applicants respectfully request entry of the Amendment and the attached executed Declarations.

Claims 1-16, 19 and 28-31 are rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Mirkin et al. (Mirkin). Applicants respectfully traverse the rejection.

Claims 1-16, 19 and 28-31 are directed to an electrical network and a method for making an electrical network wherein the electrical network comprises at least one nucleotide fiber defining the network's geometry, and one or more substances, molecules, clusters of atoms or molecules or particles bound to the nucleotide fiber or complexed continuously along the nucleotide fiber to form at least one electric or electronic component or a conductor.

The specification clearly states that a nucleotide fiber thus coated is a functionalized fiber. Page 6, lines 21-25, of the current specification clearly define a functionalized fiber as a nucleotide fiber that has been chemically or physically modified or attached with substances, clusters of atoms or molecules or particles deposited on the fiber which impart electric or electronic properties to the fiber or a part thereof. The molecules coating the functionalized fiber are in direct contact with one another. See, for example, Figures 3A, 4 and 5.

In one non-limiting example, the functionalized fiber is obtained by exposing the fibers to a solution of silver ions under conditions suitable for loading of the silver ions onto the nucleic acid fiber. The nucleotide fiber is thus overlaid with a continuous stretch of a conducting substance, i.e., silver ions, allowing electricity to flow along the functionalized fiber.

In contrast, Mirkin discloses a method for assembling colloidal gold nanoparticles into macroscopic aggregates. See the Abstract and Figure 1. In Mirkin's method, one portion of gold particles is coated with DNA oligonucleotides having sticky ends that are not complementary to each other. A second portion of gold particles are coated with DNA oligonucleotides having sticky ends that are complementary to the sticky ends of the DNA coated onto the first portion of gold particles. When the two portions are mixed together, the complementary sticky ends of the coated gold particles self-assemble into aggregates. These aggregates are not identical to the coated nucleotide fiber claimed in claims 1-16, 19 and 28-31.

As opposed to being a continuous nucleotide fiber, the DNA oligonucleotides of Mirkin are interrupted by the gold particles to which they are attached, and the gold particles themselves are not in direct contact with one another. As a result, it is inherently impossible for the aggregates of Mirkin to conduct electricity because the gold particles are not in direct contact with one another, and do not form a continuous stretch of conducting elements.

In support of this fact, inventors Yoav Eichen and Uri Sivan of the present invention conducted experiments to see if electricity can be carried along a nucleotide fiber when the metal particles attached thereto are not in direct contact with one another. As is evident in the enclosed Declarations, electricity cannot be carried along a nucleotide fiber when metal particles attached thereto do not form a continuous stretch along the nucleotide fiber. Thus, the aggregates of Mirkin, as illustrated in Fig. 1, are not identical to the coated nucleotide

fibers claimed in claims 1-16, 19 and 28-31 of the present invention. In particular, the aggregates of Mirkin, in which the gold particles are not in direct contact with one another, cannot conduct electricity.

Applicants submit that Mirkin does not teach or suggest every feature of the claimed invention. In particular, Mirkin does not teach or suggest at least one nucleotide fiber defining the network's geometry, and one or more substances, molecules, clusters of atoms or molecules or particles bound to said nucleotide fiber or complexed therewith continuously along said fiber to form at least one electric or electronic component or conductor. Further, Mirkin does not provide motivation for one of ordinary skill in the art to modify the disclosed coated gold particle aggregates to achieve the claimed coated nucleotide fiber. Still further, Mirkin teaches away from the claimed invention by requiring gold particles coated with DNA oligonucleotides. These coated gold particles cannot come into direct contact with each other, and thus cannot conduct electricity.

For at least these reasons, Applicants submit that claims 1-16, 19 and 28-31 are not anticipated by Mirkin, and that the Office Action has not established a *prima facie* case of obviousness. Thus, claims 1-16, 19 and 28-31 are patentable over Mirkin. Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 1-16, 19 and 21-31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Mirkin in view of U.S. Patent No. 5,063,417 to Hopfield (Hopfield). Applicants respectfully traverse the rejection.

Claims 1-16, 19 and 21-31 are directed to an electrical network and a method for making an electrical network wherein the electrical network comprises at least one nucleotide fiber defining the network's geometry, and one or more substances, molecules, clusters of atoms or molecules or particles bound to the nucleotide fiber or complexed continuously

along the nucleotide fiber to form at least one electric or electronic component or a conductor.

As discussed above, Mirkin does not teach or suggest every feature of the claimed invention. Further, the aggregates of Mirkin cannot conduct electricity. The Office Action indicates that Hopfield teaches how to connect chains of molecular elements to connection pads for input and output. However, combining the teachings of Mirkin and Hopfield by connecting the aggregates of Mirkin to connection pads for input and output does not achieve the claimed invention.

Neither Mirkin nor Hopfield, alone or in combination, teach or suggest every feature of the claimed invention. In particular, neither Mirkin nor Hopfield teach or suggest a nucleotide fiber that defines a network's geometry and particles complexed continuously along the nucleotide fiber to form at least one electric or electronic component or a conductor. Further, neither Mirkin nor Hopfield provide motivation for one of ordinary skill in the art to combine the two references to achieve the claimed inventions.

For at least these reasons, Applicants submit that it would not have been obvious to one of ordinary skill in the art, to modify the disclosure of Mirkin, in view of Hopfield, to practice the invention claimed in claims 1-16, 19 and 21-31, and that the Office Action has not established a *prima facie* case of obviousness. Thus, claims 1-16, 19 and 21-31 are patentable over Mirkin and Hopfield, alone or in combination. Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 17, 18 and 20 are rejected under 35 U.S.C. §112, first paragraph, as allegedly not being enabled by the specification. The Office Action indicates that unless Applicants submit evidence of working devices, the rejection will be maintained. Applicants respectfully traverse the rejection.

Claim 18 is canceled, thus rendering the rejection of this claim moot.

As indicated in U.S. Patent No. 5,063,417 to Hopfield (Hopfield), which was cited by the Examiner in this Office Action, one of ordinary skill in the art would understand how to build p/n junctions. See col. 1, lines 29-31. On page 28, line 10 - page 30, line 18, Applicants disclose how to make a network in which an n/p diode can be made according to the invention. In particular, the specification discloses forming an n/p junction diode by first binding an n-type substance (which is defined in the specification as a polymer having an electron surplus) to a first oligonucleotide. Next, Applicants disclose binding a p-type substance (which is defined in the specification as a polymer having an electron deficiency) to a second oligonucleotide. Next, Applicants disclose hybridizing the DNA nucleotides to one another, thereby bringing the p-type and n-type substances together, forming an n/p junction.

This functionalized wire is then connected to electrodes. By definition, an n/p-type junction that is attached to electrodes is a working diode, made of semiconductor polymer material, that has the ability to conduct current. This is both known to those skilled in the art, as evidenced by Hopfield, and is described sufficiently in the present specification to enable one of ordinary skill in the art to make such a diode.

On page 28, line 10 - page 30, line 18, Applicants also disclose a network in which a bipolar transistor can be made according to the invention. In particular, the specification discloses binding a p-type substance to a first nucleotide, an n-type substance to a second nucleotide, a p-type substance to a third nucleotide, and hybridizing the nucleotides together. This functionalized wire is connected to electrodes. The result is a pnp bipolar transistor. One of ordinary skill in the art would understand that there are two major types of bipolar transistors, pnp and npn bipolar transistors. In addition, this is described sufficiently in the present specification to enable one of ordinary skill in the art to make such a bipolar transistor.

MPEP §2164.03 indicates that the amount of guidance or direction needed to enable the invention is inversely related to the amount of knowledge in the state of the art as well as the predictability in the art. See In re Fisher, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970). Applicants submit that the chemical and biological technology for the claimed p/n junction and bipolar transistor are highly predictable. Specifically, Applicants submit that one of ordinary skill in the art would expect, with a high degree of predictability, that nucleotides or oligonucleotides will hybridize under appropriate conditions, which are also well known to those skilled in the art. In addition, one of ordinary skill in the art would expect, with a high degree of predictability, that p/n junctions formed and connected to electrodes (i.e., a diode) would conduct electricity. In addition, one of ordinary skill in the art would expect, with a high degree of predictability, that pnp or npn polymers joined and connected to electrodes would form bipolar transistors.

For at least these reasons, Applicants submit that claims 17 and 20 are enabled by the specification. In particular, pages 28-30 disclose binding one of two adjacent portions of a nucleotide chain fiber to a p-type semi-conducting substance, and binding the second of two adjacent portions of a nucleotide chain fiber to an n-type semi-conducting substance thereby forming a p/n junction, as claimed in claim 17. In addition, pages 28-30 disclose binding a p-type semi-conducting substance to a first nucleotide segment and binding an n-type semi-conducting substance to each of two nucleotides on either side of the first nucleotide segment; or binding an n-type semi-conducting substance to a first nucleotide segment and a p-type semi-conducting substance to each of two nucleotide segments on either side of the first nucleotide segment, thus forming a polar transistor. Reconsideration and withdrawal of the rejection are respectfully requested.

Applicants would like to bring to the Examiner's attention the fact that Applicants' invention was published in the prominent peer-reviewed journal Nature in 1998. This journal

article was submitted in the May 5, 2000, Information Disclosure Statement, which was acknowledged by the Examiner in March 2001. The Mirkin article was published in the same journal in 1996. Clearly, publication in this respectable journal is indicative of the uniqueness of the present invention.

In view of the foregoing amendments and remarks, Applicants submit that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-17 and 29-32 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

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Registration No. 36,430

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JAO:PAC/jca

Attachments:
Appendix
Declaration (2)

Date: April 26, 2002

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Claims:

Claim 18 is canceled.

Claim 32 is added.

The following is a marked-up version of the amended claims:

1. (Amended) An electric network comprising:

- at least one nucleotide fiber ~~comprising a nucleotide chain~~ defining the network's geometry; and

- one or more substances, molecules, clusters of atoms or molecules or particles bound ~~thereto~~ to said nucleotide fiber or complexed therewith continuously along said fiber to form at least one electric or electronic component or a conductor;

the network being electrically connected to an electrically conducting interface component for electric communication with an external electric component or circuitry.

3. (Twice Amended) A network according to Claim 1, comprising at least two nucleotide fibers connected to one another at a junction in which one nucleotide segment of one fiber is bound to another nucleotide segment of another fiber by a sequence-specific interaction.

4. (Twice Amended) A network according to Claim 1, comprising a junction between a first nucleotide ~~chain of one~~ fiber and a second nucleotide ~~chain of another~~ fiber, formed by a molecule, cluster of atoms or molecules or a particle bound to each of the nucleotide ~~chains~~fibers.

7. (Amended) A network according to Claim 6, wherein the chemically modified nucleotides are included in the network:

(i) in junction between nucleotide fibers for binding the nucleotide fibers to one another,

(ii) in junction between a nucleotide fiber and a linker that binds a nucleotide fiber to an electronic component of the network, or

(iii) in junction between a nucleotide fiber or an electronic component and an interface component.

10. (Twice Amended) A network according to Claim 1, having

(a) at least one conductor being a wire constructed on a nucleotide fiber comprising at least one nucleic acid chain;

(b) at least one electronic component being electrically connected to said at least one wire and being constructed either on a nucleic acid chain which has been chemically or physically modified by depositing one or more molecules, cluster of atoms or molecules or particles thereon, or being constructed by a molecule, cluster of atoms or molecules or a particle situated at a junction between two or more nucleic acid chains of different fibers.

11. (Twice Amended) A network according to Claim 1, comprising two or more nucleotide fibers assembled to form the network on the basis of sequence-specific interaction of nucleic acid chains.

13. (Twice Amended) A network according to Claim 1, wherein at least one ~~nucleic acid chain~~nucleotide fiber is made electrically conductive by substances comprising a metal bound to the ~~chain~~ nucleotide fiber or portion thereof.

14. (Twice Amended) A network according to Claim 1, wherein the network comprises at least one wire formed by non-metallic conducting substance bound to a nucleotide fiber or portion thereof.

15. (Twice Amended) A network according to Claim 1, wherein at least one nucleotide fiber has at least a portion bound to semi-conducting substances.

17. (Twice Amended) A network according to Claim 1, wherein one of two adjacent portions of at least one nucleotide fiber are bound to a p-type semi-conducting substance and the other to an n-type semi-conducting substance, whereby the two adjacent portions of the nucleotide fiber constitute a p/n junction.

19. (Twice Amended) A network according to Claim 1, comprising at least one nucleotide-based junction formed by hybridization of complementary sequences of nucleotide chains in at least two nucleotide fibers.

20. (Amended) A network according to Claim 19, wherein said junction is formed into bipolar transistors, comprising:

(a) a p-type semi-conducting substance bound to a first nucleotide ~~segment~~ fiber at the junction and an n-type semi-conducting substance bound to adjacent, second nucleotide ~~segment~~ fiber at both sides of the first nucleotide ~~segment~~fiber, or

(b) an n-type semi-conducting substance bound to a first nucleotide ~~segment~~ fiber at the junction and a p-type semi-conducting substance bound to adjacent, second nucleotide ~~segment~~ fiber at both sides of the first nucleotide ~~segment~~fiber.

22. (Amended) A network according to Claim 21, comprising at least two interface components, each one connected to at least one nucleotide fiber or electronic component of the network.

23. (Twice Amended) A network according to Claim 21, wherein said interface component is connected to a wire, said wire comprising a nucleotide fiber ~~having one or more nucleotide chains~~.

24. (Amended) A network according to Claim 23, wherein the nucleotide fiber has a nucleotide end segment, and is bound to the interface component by a specific interaction with a complexing agent bound to a linker attached to the interface component.

26. (Twice Amended) A network according to Claim 21, wherein said interface component is bound to a nucleotide ~~chain~~ fiber that is bound to an electronic component of the network.

28. (Amended) A method for making an electronic network, comprising:

(a) providing an arrangement comprising at least one electrically conductive interface component;

(b) attaching a linker to the at least one interface component;

(c) contacting said arrangement with at least one nucleotide fiber ~~comprising at least one nucleotide chain~~ with a sequence capable of binding to the linker, and permitting binding of said sequences to said linker,

(d) electrically or electronically functionalizing the at least one nucleotide ~~chain~~ fiber by depositing thereon or complexing thereto at least one substance or particles.

29. (Amended) A method according to Claim 28, wherein the network is formed by self-assembly as a result of chemical complementary and molecular recognition properties of at least one nucleotide ~~chain~~ fiber to at least one other nucleotide ~~chain~~ fiber or between at least one nucleotide ~~chain~~ fiber and at least one specific sequence or domain-recognizing complexing agent.

30. (Twice Amended) A method according to Claim 28, comprising mixing nucleotide fibers and components together and allowing them to self-assemble into a network by means of specific molecule interactions.

31. (Twice Amended) A method according to Claim 28, comprising forming junctions between nucleotide ~~chains~~ fibers and at least one molecule, cluster of atoms or molecules or particles, said molecule clusters or particles serving as an electronic component in the network.